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June 1994

Biology 30

Grade 12 Diploma Examination

Alberta
EDUCATION

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June 1994

Biology 30

Grade 12 Diploma Examination

Description

Time allotted: 2.5 h. You may take an additional 0.5 h to complete the examination if needed.
Total possible marks: 100

This is a **closed-book** examination consisting of **two** parts:

Part A
has 70 multiple-choice questions each with a value of one mark.

Part B
has 4 written-response questions for a total of 30 marks.

Instructions

- Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.
- Carefully read the instructions for each part before proceeding.
- The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Education.
- Do not fold the answer sheet.

Note: *The perforated pages at the back of this booklet may be torn out and used for your rough work.* ***No marks*** *will be given for work done on the tear-out pages.*

Part A: Multiple Choice

70 Questions

Instructions

- Read each question carefully and decide which of the choices **best** completes the statement or answers the question.
- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

  Example

  This diploma examination is for the subject of

  A. biology
  B. physics
  C. chemistry
  D. mathematics

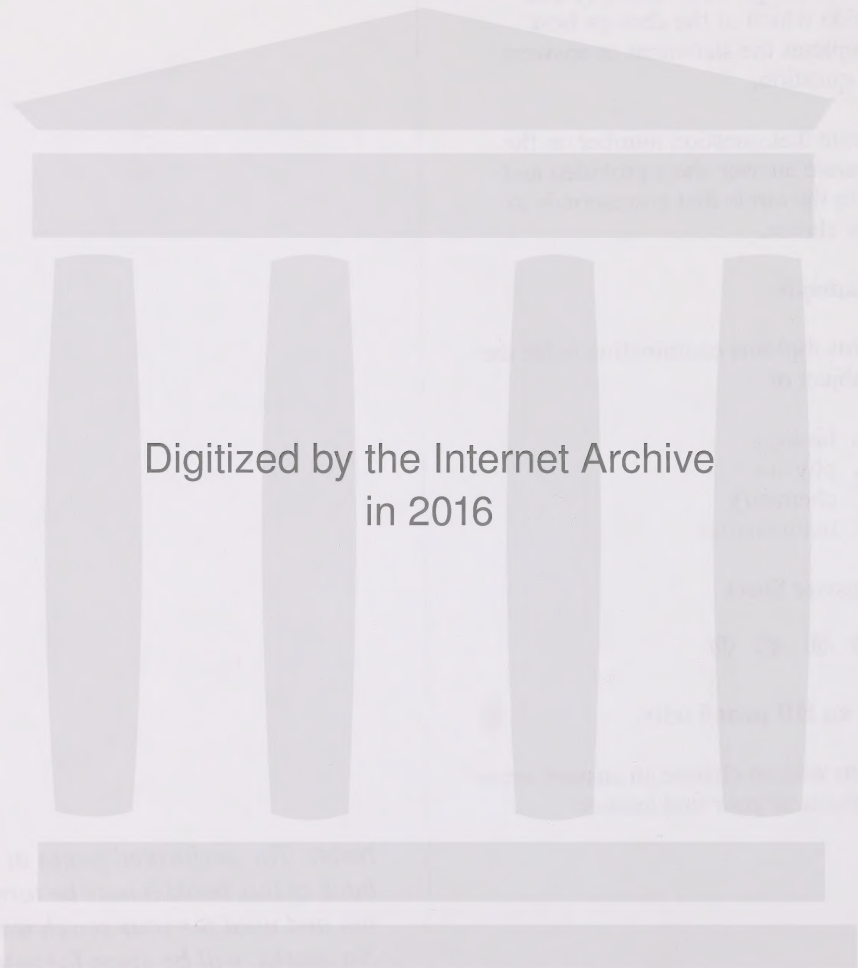
  Answer Sheet

  ● Ⓑ Ⓒ Ⓓ

- **Use an HB pencil only.**
- If you wish to change an answer, erase **all** traces of your first answer.

Note: *The perforated pages at the back of this booklet may be torn out and used for your rough work.* ***No marks*** *will be given for work done on the tear-out pages.*

Do not turn the page to start the examination until told to do so by the presiding examiner.



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1. Which cell structure packages secretions in preparation for their release from the cell?

   A. Mitochondrion
   B. Golgi complex
   C. Ribosome
   D. Lysosome

2. Which statement **best** describes the role of the nucleus in protein synthesis?

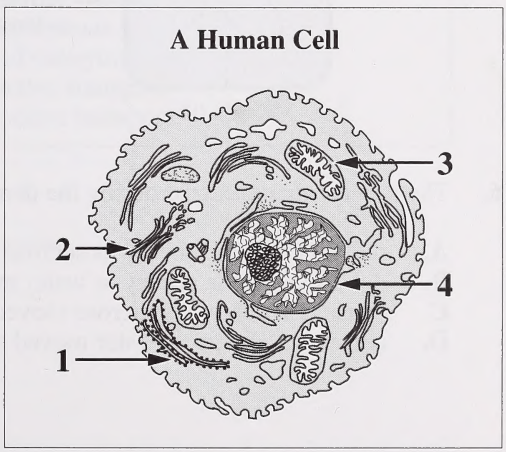
   A. The nucleus produces energy for use in protein synthesis.
   B. The nucleus stores information for use in protein synthesis.
   C. The nucleus stores amino acids for use in protein synthesis.
   D. The nucleus produces enzymes for use in protein synthesis.

3. Webbing is found between fingers and toes of young human embryos. During fetal development, the cells that compose the webbing are destroyed as a result of activity of enzymes found in

   A. nuclei
   B. ribosomes
   C. lysosomes
   D. mitochondria

4. In the diagram at the right, the organelle where protein synthesis occurs is labelled

   A. 1
   B. 2
   C. 3
   D. 4



Use the following information to answer question 5.

The Function of Mitochondria

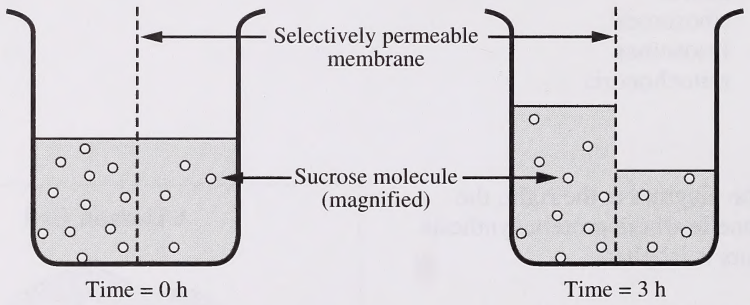
A scientist hypothesized that mitochondria release energy from glucose when oxygen is present. In order to verify this hypothesis, the scientist conducted an experiment. Two identical muscle cells were taken from a cell culture. The scientist removed all the mitochondria from one of the cells. The cells were then placed in separate solutions containing glucose and other essential nutrients. The chemical activity of the cells was monitored.

5. Monitoring which processes would help the scientist to verify the hypothesis?

A. ATP consumption and O_2 production
B. CO_2 consumption and ATP production
C. O_2 consumption and glucose production
D. Glucose consumption and CO_2 production

Use the following diagram to answer question 6.

A Demonstration of the Movement of a Substance Across a Selectively Permeable Membrane



6. The process that occurred during the demonstration

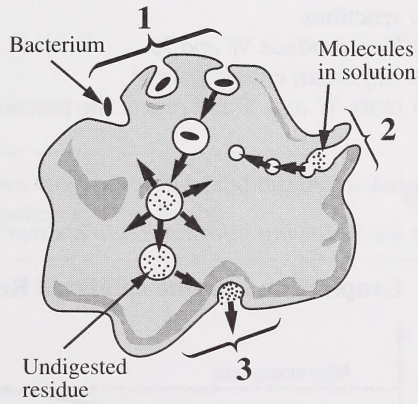
A. did not consume energy as sucrose moved by diffusion
B. did not consume energy as water moved by osmosis
C. consumed energy as sucrose moved by diffusion
D. consumed energy as water moved by osmosis

7. Which statement is the **best** example of active transport?

A. CO_2 in the blood moves into the alveoli in lungs.
B. O_2 in the alveoli moves into the blood in capillaries.
C. Plasma leaves the glomerulus to enter Bowman's capsule.
D. Amino acids in nephric filtrate are reabsorbed into the blood.

Use the following diagram to answer question 8.

A Generalized Active Cell



8. What are the names of the processes illustrated at 1, 2, and 3, respectively?

A. Phagocytosis, pinocytosis, and exocytosis
B. Active transport, endocytosis, and exocytosis
C. Pinocytosis, phagocytosis, and active transport
D. Endocytosis, phagocytosis, and active transport

---

9. In a negative feedback system, the response

A. restores stability
B. causes instability
C. intensifies the reaction
D. reinforces the stimulus

Use the following information to answer question 10.

A Model of a Chemical Reaction

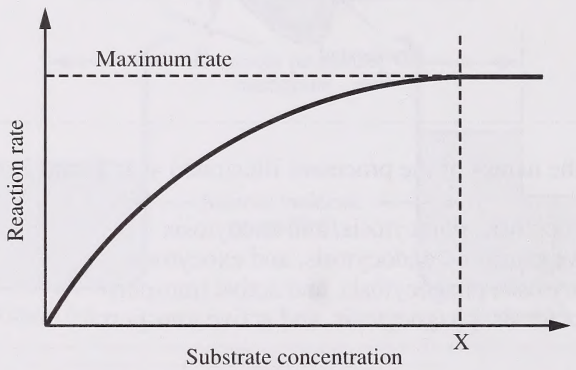
Note: There are a limited number of molecules of the chemical labelled Z but an excess number of molecules of the chemicals labelled W and X.

10. After one molecule of end product is produced, the chemical labelled Z will

A. inhibit further reactions
B. combine with Y to produce W and X
C. function as an important energy source
D. combine with more W and X and repeat the reaction

Use the following information to answer question 11.

Graph of an Enzyme-catalyzed Reaction



Note: A limited amount of enzyme was available.

11. Which is a correct conclusion based on this graph?

A. At X, enzyme molecules have been denatured.
B. At X, all active sites on enzyme molecules are occupied.
C. An increase in enzyme concentration will not change the reaction rate.
D. An increase in substrate concentration will decrease consumption of the enzyme.

12. Carbohydrates are stored in the human body as

A. ATP
B. protein
C. glucose
D. glycogen

13. Amino acids obtained from ingested food are absorbed primarily from the

A. small intestine
B. pancreas
C. stomach
D. liver

14. Ingested fats differ from most other ingested organic substances because they are absorbed from the digestive system by the

A. lacteals
B. stomach
C. capillaries
D. large intestine

15. The stomach usually does not digest its own walls because

A. pepsin is always in an inactive form
B. mucus coats the inside of the stomach wall
C. lipids inhibit the action of protein-digesting enzymes
D. gastrin inhibits the action of protein-digesting enzymes

16. Fear or anxiety can produce dryness in the mouth. Thinking about eating can increase the production of saliva. These observations indicate that production of saliva is controlled primarily by

A. reflex arcs
B. enzyme feedback
C. hormone secretion
D. nervous system activity

17. Peptic ulcers are sometimes treated by cutting parasympathetic nerves that lead to the stomach. This treatment is effective because it

A. limits gastric juice secretion, reducing digestive activity when there is no food in the stomach

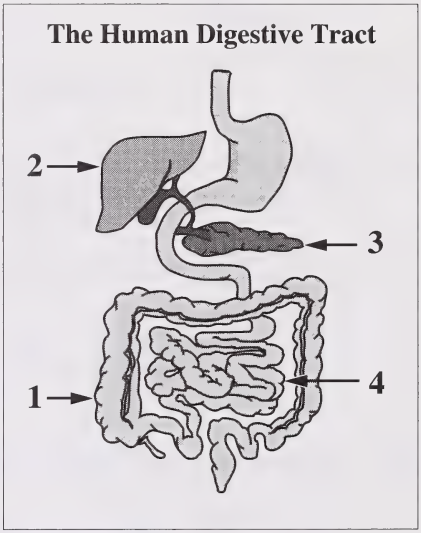
B. stops the formation of HCl, preventing secretion of protein-digesting enzymes

C. blocks sensory impulses, reducing the pain caused by the ulcer

D. increases the production of gastrin, lowering HCl production

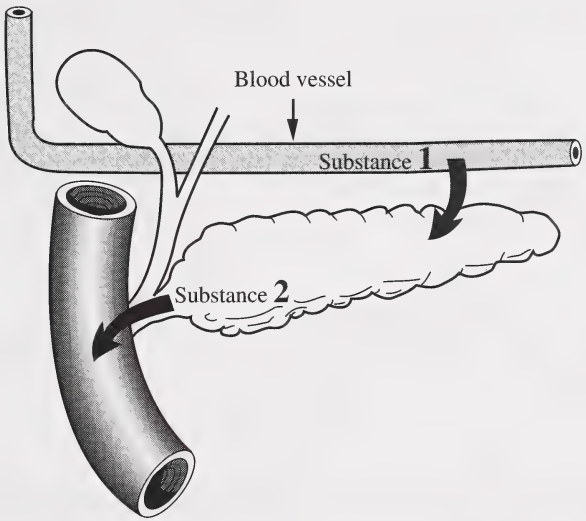
18. Carbohydrate-digesting enzymes that function in extracellular digestion are produced by which structures shown in the diagram at the right?

A. 1 and 2
B. 1 and 3
C. 2 and 4
D. 3 and 4



Use the following diagram to answer question 19.

A Portion of the Duodenum and Associated Organs



19. The action of substance 1 regulates the secretion of substance 2. Substances 1 and 2 are, respectively,

A. gastrin and bicarbonate ions
B. secretin and bicarbonate ions
C. gastrin and hydrochloric acid
D. secretin and hydrochloric acid

---

20. A piece of meat was placed in a sample of fluid extracted from a human stomach and was incubated at 37°C. Which procedure would increase the rate of digestion of the meat?

A. Decreasing the temperature to 20°C
B. Increasing the temperature to 80°C
C. Shaking the sample
D. Adding water

Use the following information to answer questions 21 to 23.

A Digestion Experiment

A student designed an experiment to test the effect of pH on the ability of enzyme X to digest egg albumin, which is a protein.

Procedure

1. The student added 3 g of egg albumin and 5 mL of enzyme X solution to each of five test tubes.
2. 5 mL of pH buffer were added to each tube to adjust the pH to the levels shown in the data table.
3. The test tubes and their contents were incubated at 37°C for 24 h.
4. After incubation, the mass of egg albumin remaining in each test tube was determined. The results were recorded in the data table.

Data Table

Test Tube	pH	Mass of Egg Albumin Remaining after 24 h (g)
I	1.0	0.4
II	3.0	0.1
III	5.0	0.7
IV	7.0	1.7
V	9.0	1.8

21. The statement in the procedure that identifies the manipulated variable in this experiment is numbered

A. 1
B. 2
C. 3
D. 4

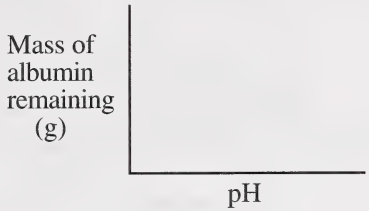
22. Considering the nature of the contents of various parts of the digestive tract and the results of the experiment, the student correctly concluded that enzyme X **best** digests protein in the

A. small intestine
B. large intestine
C. stomach
D. mouth

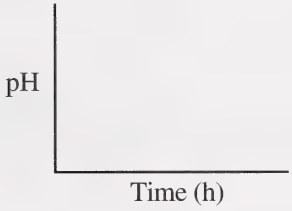
Continued

23. Which graph axes should be used to plot the data collected in this experiment?

A.



B.



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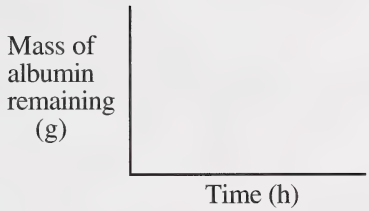

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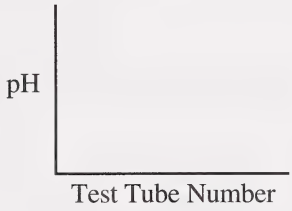


Use the following information to answer question 24.

Shortly after a rat ate a meal rich in starch, samples of liquid were taken from the vessels carrying blood to and from the rat's small intestine. Other samples of liquid were taken from the lumen (inside) of the small intestine. Analysis of these samples provided the following data:

Concentration of Substances in Intestinal Contents or Blood (mg/100 mL)

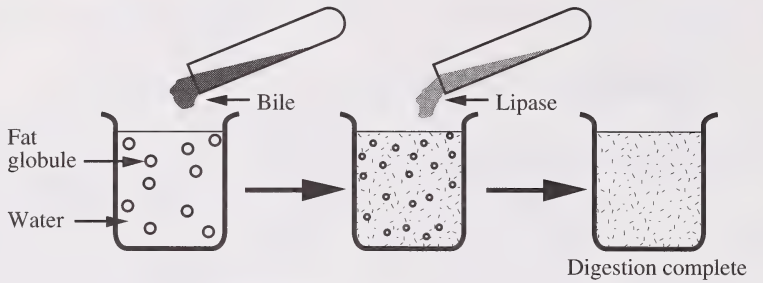
Substance	Intestinal Lumen	Artery to Small Intestine	Vein from Small Intestine
starch	1 014	0	0
maltose	250	0	0
glucose	10	60	150

24. A reasonable conclusion based on the data is that

A. glucose is transported to the pancreas
B. pancreatic amylase has completed starch digestion
C. absorption of glucose does not require expenditure of energy
D. complex carbohydrates are unable to pass through the cells lining the small intestine

Use the following diagram to answer question 25.

A Representation of Fat Digestion



25. The digestive process illustrated in the diagram **best** simulates the action within the

A. liver
B. stomach
C. pancreas
D. small intestine

Use the following information to answer question 26.

A student was given four fluid-filled test tubes and was told that each tube contained one, two, three, or four food substances. The food substances were either dissolved or suspended in distilled water. To determine the contents of each test tube, the student applied the four tests shown and recorded the results.

Test Tube	Results of Tests			
	Biuret Reagent	**Iodine Solution**	**Benedict's Reagent**	**Sudan IV Powder**
1	light blue	golden yellow	blue	dissolved
2	light blue	black	blue	dissolved
3	pink/purple	golden yellow	orange	undissolved
4	pink/purple	black	orange	undissolved

26. Which statement correctly describes the food content of one of the test tubes?

A. Test tube 1 contained protein only.
B. Test tube 2 contained starch and fat only.
C. Test tube 3 contained glucose and fat only.
D. Test tube 4 contained starch, glucose, and fat only.

27. Eating fatty foods before ingesting a prescribed drug decreases the rate of absorption of the drug into the blood. The rate of absorption decreases because fatty foods

A. lower the pH of the stomach contents
B. decrease the amount of pepsin secreted to digest the drug
C. pass quickly into the large intestine and are absorbed by villi
D. are relatively insoluble in stomach juices and coat the lining of the stomach

28. Blood from the liver is returned to the heart in the

A. inferior vena cava
B. superior vena cava
C. left pulmonary veins
D. right pulmonary veins

29. Which blood component transports urea to the kidney?

A. Erythrocytes
B. Hemoglobin
C. Leukocytes
D. Plasma

30. A person with bone marrow damage would likely have problems with

A. storage of antibodies and formation of blood plasma
B. absorption of minerals and formation of antibodies
C. clotting of blood and formation of red blood cells
D. absorption of calcium and formation of vitamins

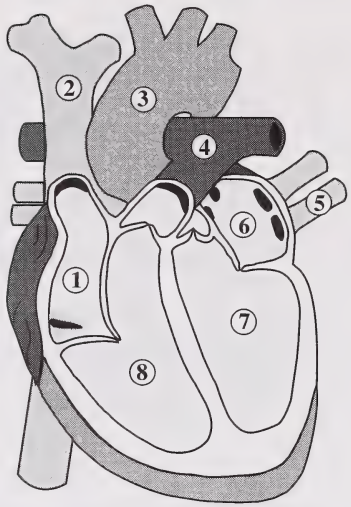
31. A person's heart rate will increase in direct response to

A. an increase in parasympathetic impulses
B. a decrease in sympathetic impulses
C. an increase in plasma adrenaline
D. a decrease in plasma glucose

32. In the diagram at the right, which labelled structures would normally contain blood with a relatively high concentration of oxyhemoglobin?

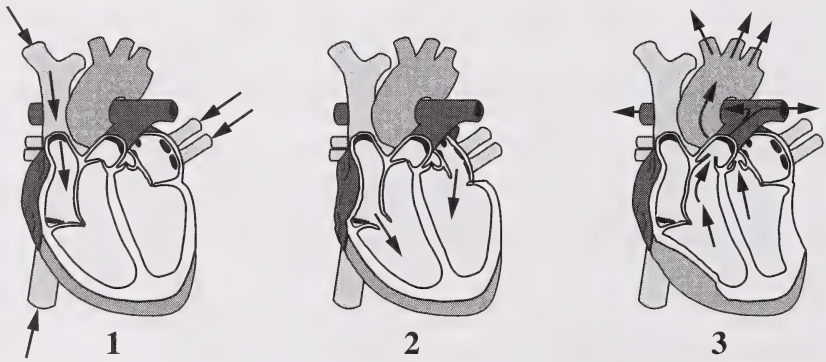
A. 1 and 8
B. 2 and 5
C. 3 and 4
D. 6 and 7

A Longitudinal Section of a Human Heart



Use the following diagrams to answer question 33.

Some Events Occurring During Contraction of the Human Heart



1 Atrial filling

2 Atrial contraction

3 Ventricular contraction

33. Which statement correctly describes the position of valves during the events shown in the diagrams?

A. AV valves are closed in diagram 1 and diagram 2.
B. Semilunar valves are closed in diagram 1 and diagram 3.
C. AV valves are open in diagram 2 and semilunar valves are open in diagram 3.
D. Semilunar valves are open in diagram 2 and AV valves are open in diagram 3.

34. Carbon monoxide is a poison because it directly interferes with

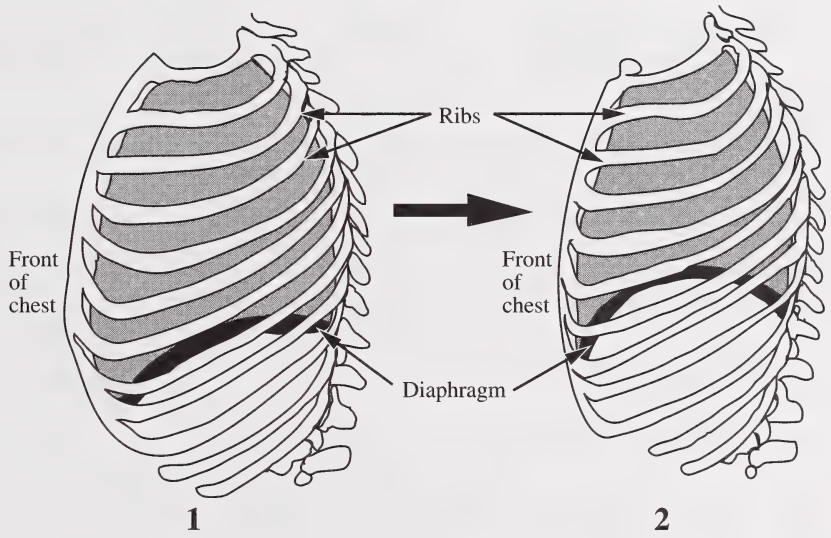
A. neural activity in the medulla oblongata
B. anaerobic respiration in body tissues
C. transport of oxygen in the blood
D. diffusion of gases in the alveoli

35. Emphysema affects body homeostasis by

A. decreasing the rate of breathing
B. decreasing the diameter of the bronchioles
C. reducing the amount of carbon dioxide in the blood
D. reducing the lung surface area available for gas exchange

Use the following diagrams to answer question 36.

Side Views of the Chest Cavity During Breathing Movements



36. As the ribs and diaphragm move from the positions shown in diagram 1 to the positions shown in diagram 2, the air pressure in the alveoli is

A. less than atmospheric pressure and is causing air to be inhaled
B. less than atmospheric pressure and is causing air to be exhaled
C. greater than atmospheric pressure and is causing air to be inhaled
D. greater than atmospheric pressure and is causing air to be exhaled

37. The process that occurs in anaerobic respiration but not in aerobic respiration is the

A. transfer of H^+ to oxygen
B. production of lactic acid
C. formation of ATP
D. release of CO_2

38. If active transport of substances in the kidney stops, it may be due to toxins that inhibit the enzymes found within which cell organelles?

A. Vacuoles
B. Ribosomes
C. Lysosomes
D. Mitochondria

Use the following information to answer question 39.

In humans, samples of exhaled air are easily collected and can be compared to atmospheric air by gas analysis. From the results, a person's respiratory quotient (RQ) can be calculated.

$$RQ = \frac{\text{volume of } CO_2 \text{ produced}}{\text{volume of } O_2 \text{ used}}$$

RQ values are dependent on the type of metabolism and the type of fuel that is metabolized. The table below provides data for the major types of metabolism.

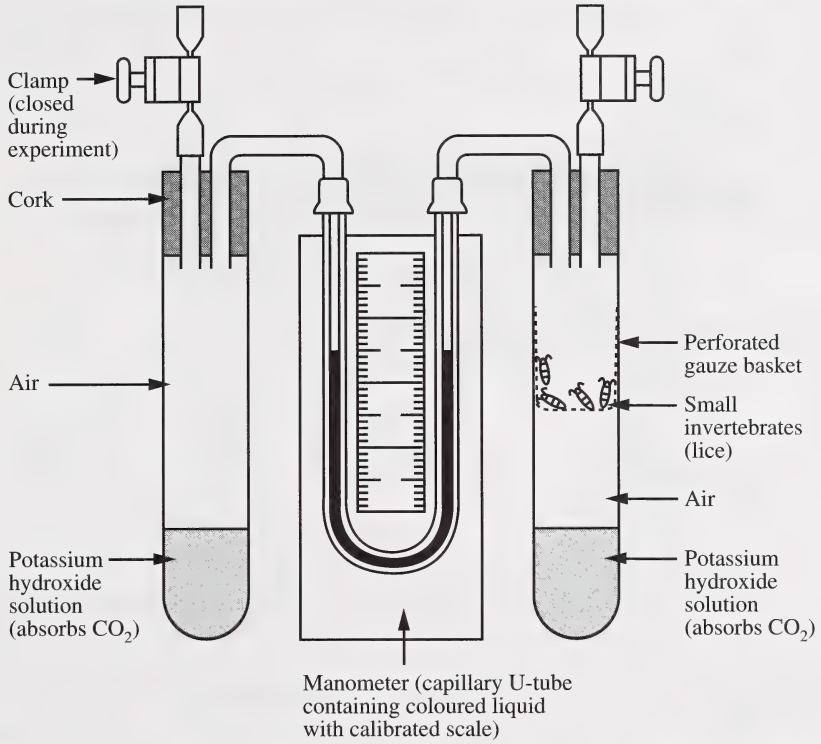
Type of Metabolism	Type of Fuel	RQ
Aerobic	glucose	1.0
	fats	0.7
	proteins	0.8
Anaerobic	glucose	greater than 1.0

39. Based on the data in the table, which statement is correct?

A. An RQ greater than 0.7 indicates that a person is overweight.
B. A person's RQ would increase during a long period of fasting.
C. The RQ of a person with untreated diabetes would be greater than 1.0.
D. The RQ of a person is likely to rise when muscles fatigue during strenuous exercise.

Use the following diagram to answer question 40.

A Respirometer



40. A student used a respirometer to determine metabolic rates of some invertebrates (lice). In the experiment, the manipulated variable and one responding variable, respectively, are

A. temperature and number of lice
B. oxygen uptake and temperature
C. number of lice and oxygen uptake
D. CO_2 production and number of lice

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41. In the human kidney, increased blood pressure **directly** affects the function of the

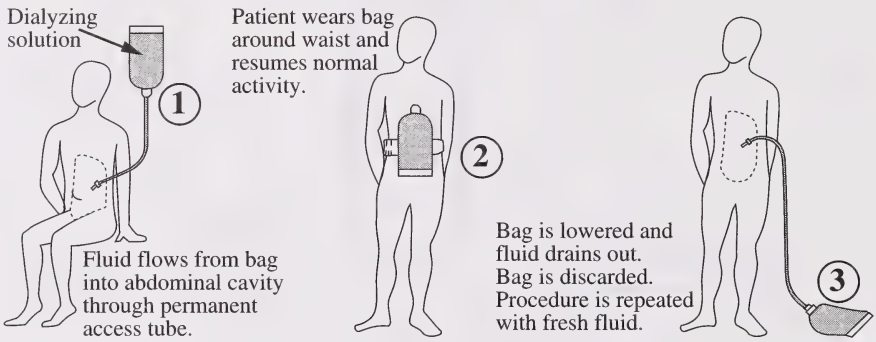
A. glomerulus
B. distal tubule
C. loop of Henle
D. collecting duct

42. As filtrate is processed in the kidney to form urine, there is a change in the concentration of solutes present in the fluid within nephric tubules. Which substance in this fluid undergoes the greatest increase in concentration?

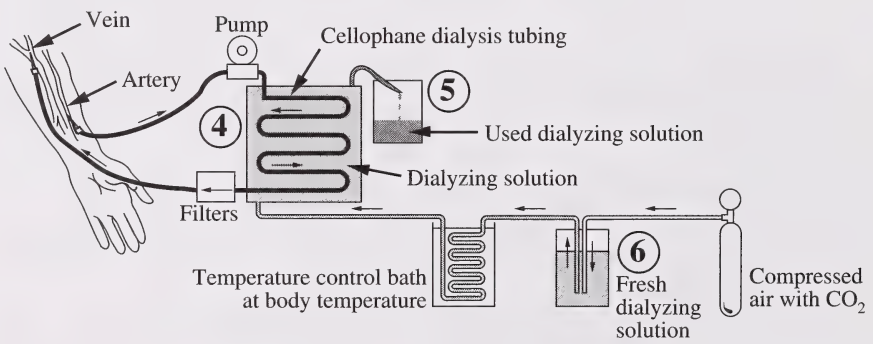
A. Urea
B. Glucose
C. Amino acids
D. Sodium ions

Use the following information to answer question 43.

Continuous Peritoneal (Abdominal) Dialysis



The Artificial Kidney Machine



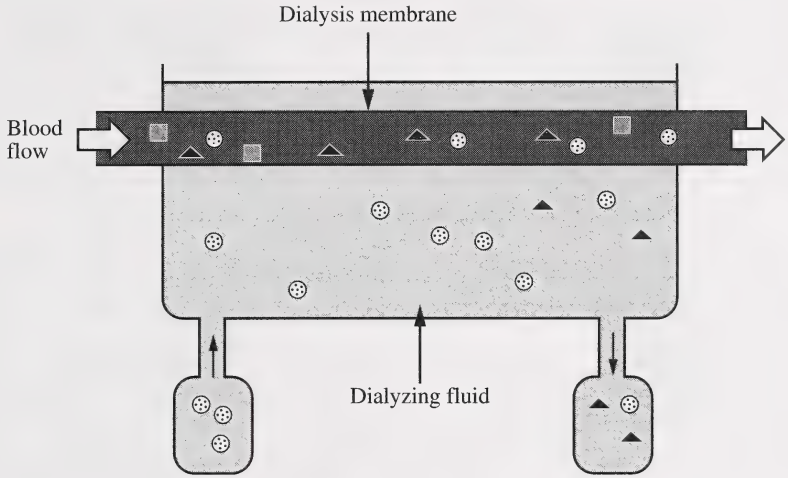
43. Peritoneal (abdominal) dialysis and the artificial kidney machine function in similar ways. Which steps are similar in both procedures?

A. 1 and 5, 2 and 4, 3 and 6
B. 1 and 5, 2 and 6, 3 and 4
C. 1 and 6, 2 and 4, 3 and 5
D. 1 and 6, 2 and 5, 3 and 4

Use the following information to answer question 44.

A Schematic Representation of a Dialyzing Machine

The symbols in the diagram represent some molecules that are present in blood and in dialyzing fluid.



44. Which row correctly identifies the symbols used in the diagram?

Row	Symbol		
			
A	protein	glucose	urea
B	glucose	protein	urea
C	glucose	urea	protein
D	protein	urea	glucose

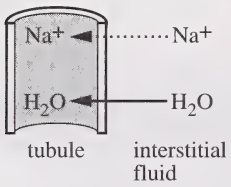
45. In the liver, urea is produced as a result of the breakdown of

A. fats
B. glucose
C. glycogen
D. amino acids

46. Which is the **best** illustration of the transport of Na^+ and H_2O between the distal tubule of a nephron and its surrounding interstitial fluid in a dehydrated person?

Note: ——► represents active transport
·····► represents passive transport

A.



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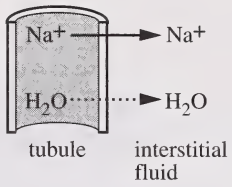

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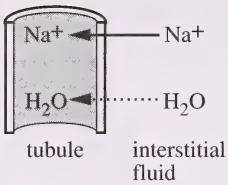

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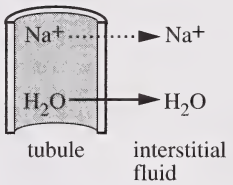
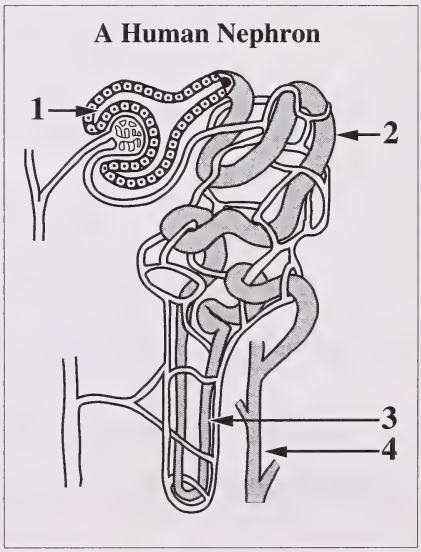


Use the diagram at the right to answer questions 47 and 48.

47. The fluid that is **most** similar in composition to plasma is found in the structure labelled

A. 1
B. 2
C. 3
D. 4



48. If the structure labelled 3 were reduced in length, what would happen in the kidney, even if ADH and aldosterone were present?

A. Urine volume would increase.
B. Blood volume would increase.
C. More Na^+ ions would be reabsorbed.
D. Osmotic pressure in the blood would decrease.

49. When a person drinks alcohol, the amount of urine produced increases. The physiological reason for this is that alcohol

A. stimulates ADH secretion and more water is reabsorbed
B. stimulates ADH secretion and less water is reabsorbed
C. inhibits ADH secretion and more water is reabsorbed
D. inhibits ADH secretion and less water is reabsorbed

Use the following information to answer question 50.

Some Characteristics and Components of Normal Urine

Characteristic/Component	Description/Amount
Volume	1 – 2 litres/24 h
Colour	yellow or amber
Cloudiness	transparent when fresh but becomes cloudy upon standing
pH	4.6 – 8.0
Specific gravity (density)	1.001 – 1.035
Urea	25.0 – 35.0 g/24 h
Creatinine	1.5 g/24 h
Uric Acid	0.4 – 1.0 g/24 h
NaCl	15.0 g/24 h
Potassium ions	3.3 g/24 h
Sulfate ions	2.5 g/24 h
Phosphate ions	2.5 g/24 h
Other substances	4.8 g/24 h

50. Why are some values in the table given as ranges of numbers?

A. Waste production occurs only after meals or exercise.
B. Some substances are continually filtered by the kidneys.
C. Excretion of substances is determined by activity and diet.
D. Many substances are retained in the blood and not excreted.

51. When a person eats a candy bar that has a high sugar content, under normal conditions the pancreas secretes

A. insulin, thereby increasing the blood sugar levels
B. insulin, thereby decreasing the blood sugar levels
C. glucagon, thereby increasing the blood sugar levels
D. glucagon, thereby decreasing the blood sugar levels

52. Which structures are involved in negative feedback control of thyroxine secretion?

A. Pituitary gland, thyroid gland, and adrenal gland
B. Hypothalamus, pituitary gland, and thyroid gland
C. Hypothalamus, medulla oblongata, and thyroid gland
D. Pituitary gland, adrenal gland, and medulla oblongata

53. When reading, a person with astigmatism will see some lines in sharp focus while others appear blurred. Astigmatism is caused by the

A. lens becoming cloudy and rigid
B. inability of the iris to contract or dilate
C. curvature of the cornea or lens not being symmetrical
D. number of cones on some parts of the retina being deficient

54. Sound waves and the nerve impulses created by them follow which pathway through the ear?

A. Ear drum → cochlea → ossicles → auditory nerve
B. Ear drum → ossicles → organ of Corti → auditory nerve
C. Ossicles → cochlea → tympanic membrane → auditory nerve
D. Ossicles → eustachian tube → semicircular canals → auditory nerve

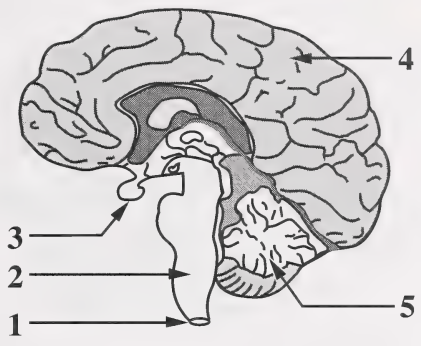
55. The usual direction of nerve impulse transmission in a neuron is from

A. dendrite to cell body to axon
B. axon to cell body to dendrite
C. dendrite to axon to cell body
D. axon to myelin sheath to cell body

56. A gymnast is able to maintain balance while walking a tightrope. In the diagram at the right, the regions of the brain directly involved in maintaining balance are labelled

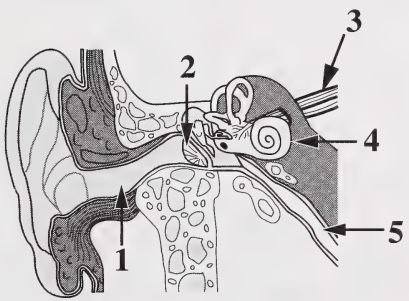
A. 1 and 2
B. 2 and 3
C. 3 and 4
D. 4 and 5

The Human Brain

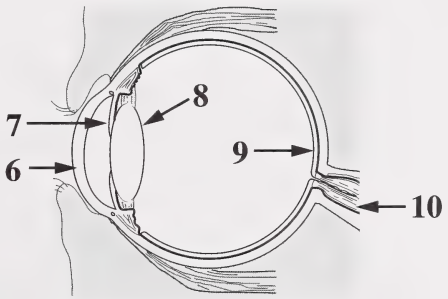


Use the following diagrams to answer questions 57 and 58.

The Human Ear



The Human Eye



57. Which structures in these diagrams are sensory nerves?

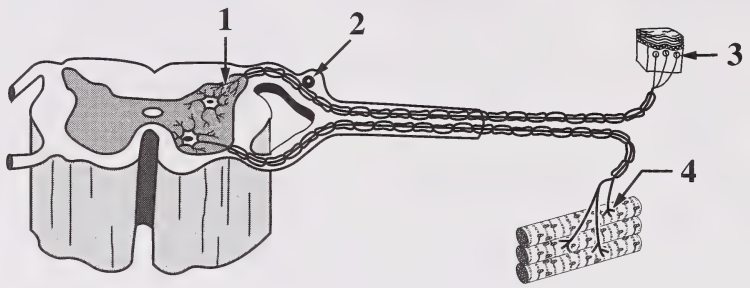
A. 2 and 6
B. 3 and 10
C. 4 and 7
D. 5 and 9

58. Which structures in these diagrams convert sound energy and light energy into nerve impulses?

A. 1 and 6
B. 2 and 8
C. 3 and 10
D. 4 and 9

Use the following information to answer question 59.

A Human Reflex Arc



59. Jackie touched a hot stove with her hand and withdrew it automatically. In order for her cerebrum to also be activated by the same stimulus, an additional nerve pathway would have to be used. This pathway would branch off the reflex arc at the location labelled

A. 1
B. 2
C. 3
D. 4

Use the following information to answer question 60.

Activities During Impulse Transmission Along a Neuron

1. Diffusion of ions
2. Release of acetylcholine
3. An increase in the permeability of axon membrane
4. An increase in the use of ATP
5. Release of cholinesterase
6. Conduction of impulse

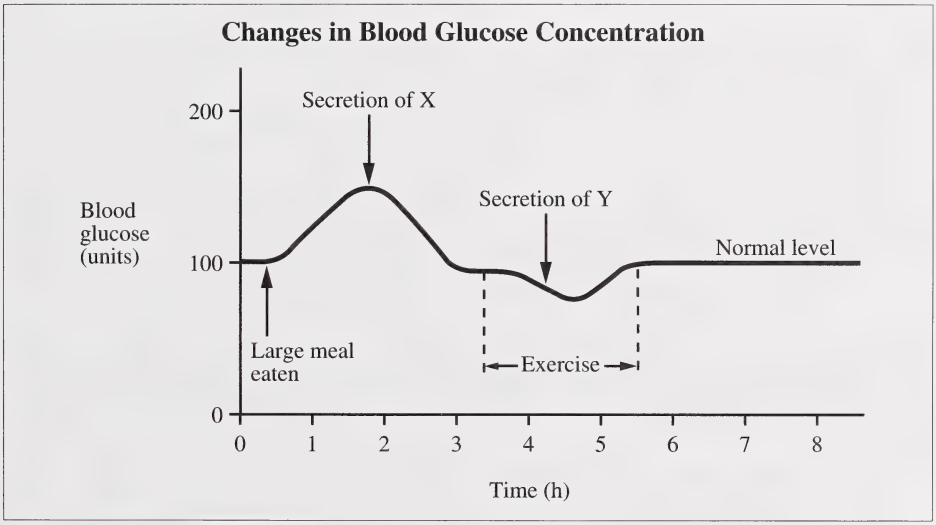
60. After the dendrites of a neuron are stimulated, which sequence of activities occurs in the axon and the synapse?

A. 3, 1, 6, 4, 2, and 5
B. 3, 4, 1, 6, 5, and 2
C. 4, 1, 3, 6, 2, and 5
D. 4, 3, 1, 6, 5, and 2

61. An Olympic downhill skier, attempting to win a gold medal, is midway through the race. Which row accurately describes the effects of the sympathetic nervous system on the skier's body components?

Row	Blood Vessels in Skin	Sphincters of the Digestive Tract	Bronchioles
A	constricted	contracted	dilated
B	constricted	relaxed	constricted
C	dilated	contracted	constricted
D	dilated	relaxed	dilated

Use the following information to answer question 62.



62. The source of glucose for restoration of the normal blood glucose concentration after exercise was

A. the glucose stored between hours 1 and 2 of the experiment
B. the high blood glucose at 2 h
C. stored glycogen
D. secretion Y

Use the following information to answer question 63.

Glaucoma

Glaucoma is a common cause of blindness. This disease develops when aqueous humour (fluid) flows into the anterior chamber of the eye faster than it drains out. As a result, the fluid pressure rises significantly. The increased pressure is transmitted to all parts of the eye. In time, the blood vessels that supply nutrients to the retina may be squeezed closed.

63. Glaucoma most likely causes blindness because

A. fluid in the eye may become too dense to transmit light waves properly
B. rods and cones may not receive enough oxygen to respire aerobically
C. the optic nerve may not be able to transmit impulses to the brain
D. the lens in the eye may not be able to focus images on the retina

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64. The sliding-filament hypothesis of muscle contraction states that the energy in ATP is used to break and re-form attachments between

A. actin and fibrin
B. actin and myelin
C. myosin and actin
D. myosin and fibrin

65. The pH of the cytoplasm in muscle cells at rest is 7.4. Which is likely a correct description of the pH of the cytoplasm in muscle cells after a period of very strenuous exercise?

A. The pH would be less than 7.4 because of a lack of ATP.
B. The pH would be greater than 7.4 because of a lack of O_2.
C. The pH would be greater than 7.4 because of an accumulation of CO_2.
D. The pH would be less than 7.4 because of an accumulation of lactic acid.

Use the following information to answer question 66.

A whole muscle was stimulated twice by electric currents of differing voltage. In each case, the force of the muscle's contraction was recorded.

Trial	Strength of Stimulus (mV)	Resulting Force of Contraction (g)
I	25	100
II	50	190

66. The primary reason why the contraction was stronger in trial II than in trial I is that, in trial II, more

A. oxygen was used
B. ATP was consumed
C. muscle fibres were involved
D. carbon dioxide was produced

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67. The sequence of structures through which sperm pass from the seminiferous tubules in a male to the egg in a female is

A. interstitial cells → ureter → vagina → uterus
B. interstitial cells → seminal vesicles → urethra → vagina
C. vas deferens → ureter → vagina → Fallopian tube (oviduct)
D. vas deferens → urethra → vagina → Fallopian tube (oviduct)

68. During pregnancy, the hormonal function of the corpus luteum is taken over by the

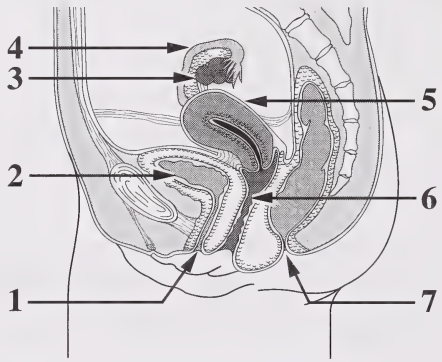
A. uterus
B. embryo
C. placenta
D. pituitary

69. It can be shown that surgical removal of the testes of a human male results in a marked increase in the pituitary secretions of both FSH and LH. Which concept about feedback control does this result support?

A. LH and FSH secretion inhibits testosterone production.
B. Testosterone inhibits pituitary secretion of LH and FSH.
C. The absence of sperm prevents secretion of FSH and LH.
D. The lack of secondary sexual characteristics stimulates secretion of FSH and LH.

Use the following diagram to answer question 70.

A Section of the Lower Torso of a Human Female



70. Which labelled structure has a unique characteristic not shared by any of the other labelled structures?

A. Structure 1 opens to the external environment.
B. Structure 2 has a wall containing smooth muscle.
C. Structure 4 has a ciliated lining.
D. Structure 5 is influenced by hormones produced elsewhere in the body.

You have now completed Part A. Proceed directly to Part B.

Part B: Written Response

4 Questions

Instructions

- Read each question carefully.
- Write your answers in the examination booklet as neatly as possible.
- Communicate your answers in clear, complete sentences unless the response format dictates otherwise. Marks will be awarded for pertinent explanations and answers. Question 1 has three marks allotted for written communication skills.

***Note**: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No mark**s will be given for work done on the tear-out pages.*

Start Part B immediately.

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Total: 10 marks

Use the following information to answer question 1.

Hypothermia

The human body normally uses homeostatic mechanisms to maintain a constant body temperature of approximately 37°C.

Hypothermia is a condition in which the internal temperature of a person's body drops significantly. As the body's temperature drops, the person loses coordination and becomes confused, disoriented, and weak. The person may become sleepy and eventually lose consciousness.

Hypothermia can be life-threatening if not treated, but in some cases hypothermia may be purposely induced (caused) in patients about to undergo surgery.

1. Explain the effects of hypothermia on **two** different body processes or systems. (4 marks)

Why might surgeons choose to induce hypothermia in their patients? Describe one method that surgeons might use to induce hypothermia and one method they could use to monitor hypothermia in patients. (3 marks)

Present your response in paragraphs that are clearly written and logically organized. (3 marks)

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Total: 6 marks

2. Scientific studies have advanced our knowledge of the structures of the reproductive system and the function of reproductive hormones. The application of this knowledge has led to the development of new reproductive technologies.

Select **three** specific regulatory hormones and/or structures of the mature human reproductive system. Describe **one** reproductive function of each. Then describe **one** technology that is used to enhance or hinder **each** of these functions.

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Total: 4 marks

Use the following information to answer question 3.

The Use of Vampire Bat Saliva in Prevention of Blood Clotting

A vampire bat sucks liquid blood from its prey. Usually this procedure takes more than 15 minutes. Animal blood will normally start clotting long before this time is up, but vampire bat saliva contains a substance that prevents clotting. Vampire bat saliva can also be used to dissolve blood clots. Biochemists have discovered a key ingredient in vampire bat saliva called bat-PA. When combined with fibrin in a blood clot, bat-PA is activated and dissolves the clot.

Human blood contains a substance called human-PA that normally prevents blood from clotting while it circulates in the body. Human-PA is activated by contact with fibrinogen but not by contact with fibrin.

3. a. Explain how a drug derived from bat-PA could be used to prevent heart attacks or strokes in humans. What is the advantage of using bat-PA instead of human-PA to prevent heart attacks or strokes? **(3 marks)**

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b. How could a drug derived from bat-PA be harmful to humans? **(1 mark)**

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Total: 10 marks

Use the following information to answer question 4.

Does Cigarette Smoking Affect the Fitness of Young Adults?

There is no controversy about the fact that cigarette smoking is a major cause of several pulmonary and cardiovascular disorders. In an attempt to examine the relationship between cigarette smoking and fitness in young adults, some researchers conducted an experiment.

The subjects in the study ranged in age from 22 to 26 years. There were 9 smokers (5 males, 4 females) and 13 non-smokers (4 males, 9 females). The participants exercised on a treadmill for 12 minutes. Physiological data were collected before and after exercise. Some of the data are shown in table 1.

Table 1: Some Average Physiological Data for Smokers and Non-smokers

Physiological Factor	Smokers	Non-Smokers
Resting heart rate (beats/min)	81.2	78.5
Peak heart rate after exercise (beats/min)	186.2	190.6
Resting blood pressure (mm Hg)	118/82	117/79
Peak blood pressure after exercise (mm Hg)	159/77	159/72
Arterial oxygen saturation: percent of oxygen in blood compared to maximum amount possible (%)	91	92.4

(1 mark)

4. a. Provide **one** hypothesis that the researchers likely proposed before they developed their experimental procedure.

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(1 mark)

b. Identify the manipulated variable in the experiment.

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c. Identify **one** instrument that was likely used to collect any of the data presented in **table 1** and indicate what it measures. **(1 mark)**

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d. Compare the average data for smokers and non-smokers for **one** physiological factor shown in **table 1**. Identify and explain a cause for the difference in the data between the two groups. **(2 marks)**

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The researchers also measured the subjects' peak ventilation (amount of air moved into the lungs in one minute) after exercise. The average results are shown in table 2.

Table 2: Peak Ventilation after Exercise (L/min) for Smokers and Non-smokers

Smokers	Non-Smokers
95.4	97.2

e. State **one** conclusion you can derive from the data in **table 1** and explain how the data in **table 2** could be used to support that conclusion. **(2 marks)**

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(1 mark)

f. It is often difficult to interpret data and generate valid explanations from experiments that involve human subjects. Explain why it is difficult to design valid experiments that use humans as subjects.

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(2 marks)

g. Could the results of this study be used by government officials to justify an increase in taxes on tobacco products? Explain your answer.

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You have now completed the examination.
If you have time, you may wish to check your answers.

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